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ABSTRACT

Focusing on machine repairers and operators, this document is one in a series of forty-one reprints from the Occupational Outlook Handbook providing current information and employment projections for individual occupations and industries through 1985. The specific occupations covered in this document include appliance repairers, bowling-pin-machine mechanics, business machine repairers, computer service technicians, electric sign repairers, instrument repairers, motion picture projectionists, and vending machine mechanics. The following information is presented for each occupation or occupational area: a code number referenced to the Dictionary of Occupational Titles; a description of the nature of the work; places of employment; training, other qualifications, and advancement; employment outlook; earnings and working conditions; and sources of additional information. In addition to the forty-one reprints covering individual occupations or occupational areas (CE 017 757-797), a companion document (CE 017 756) presents employment projections for the total labor market and discusses the relationship between job prospects and education. (BM)

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Machine Repairers and Operators

Reprinted from the
Occupational Outlook Handbook,
1978-79 Edition.
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Bureau of Labor Statistics
1978

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Containing the midpoints of the legs of right triangle *RST*, whe
pt. (−1, 5), and *T* is pt. (3, 4).

Containing the longer diagonal of a quadrilateral whose verti
pts. (1, 2), (−2, −2), (1, −1), and (6, 4).

Show that the equations $y - 1 = \frac{1}{2}(x + 3)$ and $y - 4 = \frac{1}{2}(x$
are equivalent.

An equation of the line containing pts. (−2, 3) and (4, −1)
written in the form $y - 3 = -\frac{1}{2}(x + 2)$ or in the
$y + 1 = -\frac{1}{2}(x - 4)$, depending upon which point you take
(x_1, y_1). Show that the two equations are equivalent.

Show that the equations are equivalent.

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1) \qquad y - y_2 = \frac{y_2 - y_2}{x_2 - x_2}(x -$$

State the equation of a line through pt. (p, q) and parallel to
containing pts. (a, b) and (c, d). $(a \neq c)$.

U.S. DEPARTMENT OF HEALTH,
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CE 017 779

APPLIANCE REPAIRERS

(D.O.T. 637.281, 723.381, 723.844, and 827.281)

Nature of the Work

In the past, most household chores such as cooking and cleaning were performed by hand and often involved a great deal of time and physical effort. Today, a variety of labor-saving appliances make many household jobs much simpler to do. Microwave ovens cook in minutes meals that once took hours to prepare. Washers and dryers clean clothes with little physical effort. Indeed the number of household jobs machines can do is almost limitless. Even simple tasks such as cooking a hamburger or opening a can are done with appliances made specifically for those purposes. Servicing these machines is the job of the appliance repairer.

Appliance repairers usually specialize in servicing either portable appliances such as toasters and irons or major appliances such as refrigerators and ranges. In large repair shops, they may specialize in particular items such as clothes washers and dryers or refrigerators and freezers. Repairers generally do not install major appliances. This job usually is done by technicians who work for retail stores.

Portable appliances and major appliances that are rebuilt for resale are worked on in shops. Major appliances usually are repaired in customers' homes by appliance repairers who carry their tools and a number of commonly used parts with them in a truck.

To determine why an appliance is not working properly, appliance repairers operate it to detect unusual noises, overheating, or excess vibration. Repairers also look for common sources of trouble such as faulty electrical connections. They may disassemble the appliance to examine the mechanical and electrical parts. To check electric systems, repairers follow wiring diagrams and use testing devices, such as ammeters, voltmeters, and ohmmeters.

After locating the trouble, the repairer makes the necessary repairs or replacements. The repair procedure varies with the type of appliance and repair involved. To fix a portable appliance such as a toaster, the repairer may replace a defective heating element. To fix a major appliance such as a washer, the repairer may replace worn bearings, transmission belts, or gears. To remove old parts and install new ones, repairers use common handtools, including screwdrivers, soldering irons, files, and pliers, and special tools designed for particular appliances. Repairers operate the appliance after completing a repair to check their work.

Repairers may answer customers' questions and complaints about appliances and frequently advise customers about the care and use of the appliance. For example, they may show the owners the proper loading of automatic washing machines or how to arrange dishes in dishwashers.

Appliance repairers may give customers estimates on the cost of repairs and collect the payment for the repairs. They also may keep records of parts used and hours worked on each job.

Places of Employment

About 144,000 people were employed as appliance repairers in 1976. Most repairers work in independent appliance stores and repair shops. Others worked for service centers operated by appliance manufacturers, department stores, wholesalers, and gas and electric utility companies.

Appliance repairer fixing electric range.

Appliance repairers are employed in almost every community, but are concentrated in the more highly populated States and metropolitan areas.

Training, Other Qualifications, and Advancement

Most appliance repairers start as helpers and acquire their skills through on-the-job training. The form of training varies among companies and usually depends on the type of appliance repaired by the company. In some shops that fix portable appliances, helpers work on a single type of appliance, such as vacuum cleaners, until they master its repair. Trainees then move on to work on a different type of appliance; this process continues until they can repair a variety of appliances. In other shops, helpers progress from simple jobs, such as replacing a switch, to more difficult jobs such as rewiring an appliance.

In companies that repair major appliances, beginners usually learn by helping experienced repairers during house calls. In other cases, they learn basic skills by working in the shop rebuilding used parts such as washing machine transmissions.

Many helpers receive supplemental instruction through training seminars that are conducted periodically by appliance manufacturers. These seminars usually last 1 or 2 weeks and deal with the repair of one type of appliance such as ovens. Up to 3 years of on-the-job training may be needed to become skilled in all aspects of repairing some of the more complex appliances.

Some large companies such as department store chains have formal training programs, which include home study courses and shop classes, where trainees work with demonstration appliances and other training equipment.

Experienced repairers continue to attend training classes periodically, and study service manuals to become familiar with new appliances and the proper ways to repair them.

Formal training in appliance repair and related subjects is available from some vocational schools, technical schools, and community colleges. However, graduates of these schools must gain on-the-job experience to become fully qualified repairers.

Persons who want to become appliance repairers generally must have a high school diploma. High school or vocational school courses in electricity are very helpful, because most repairs involve work with electrical equipment. Mechanical aptitude is also desirable. Appliance repairers who work in customers' homes must be able to get along with people.

Appliance repairers who work in large shops or service centers may be promoted to supervisor, assistant service manager, or service manager. A few may advance to managerial positions such as regional service manager or parts manager for appliance manufacturers. Preference is given to those who show ability to get along with coworkers and customers. Experienced repairers who have sufficient funds may open their own appliance stores or repair shops.

Employment Outlook

Employment of appliance repairers is expected to grow about as fast as the average for all occupations through the mid-1980's. In addition to the jobs created by growth of this occupation, many openings will arise each year from the need to replace experienced repairers who retire, die, or transfer to other occupations.

The number of appliances in use is expected to increase very rapidly as a result of increases in population and income, and the introduction of new and improved appliances. Maintaining this large number of appliances will increase the need for qualified appliance repairers.

People who enter the occupation should have steady work because the appliance repair business is not very sensitive to changes in economic conditions.

Earnings and Working Conditions

Hourly earnings of appliance repairers ranged from $4 to $7 in 1976, based on the limited data available. The starting rate for inexperienced trainees was about $3 an hour. The wide variations in wages reflect differences in the repairers' skill and experience, geographic location, and the type of equipment serviced.

Repair shops generally are quiet, well-lighted, and adequately ventilated. Working conditions outside the shop vary considerably. For example, repairers sometimes work in narrow spaces and uncomfortable positions amidst dirt and dust. Those who repair appliances in homes may spend several hours a day driving, although the use of 2-way radios has decreased this time.

Appliance repair work generally is safe, although accidents are possible while handling electrical parts or lifting and moving large appliances. Inexperienced workers are shown how to use tools safely and how to avoid electric shock.

Appliance repairers usually work with little or no direct supervision. This feature of the job appeals to many people.

Many appliance repairers belong to the International Brotherhood of Electrical Workers.

Sources of Additional Information

For further information about jobs in the appliance service field, contact local appliance repair shops, appliance dealers and utility companies, or the local office of the State employment service.

Information about training programs or work opportunities also is available from:

Association of Home Appliance Manufacturers, 20 N. Wacker Dr., Chicago, Ill. 60606.

BOWLING-PIN-MACHINE MECHANICS

(D.O.T. 829.281)

Nature of the Work

An important piece of machinery in the modern bowling center is the automatic pinsetter. It returns the ball to the bowler, clears the fallen pins from the alley, and resets pins for the next roll. When this complex

machine fails to work properly, the game is held up and the bowling center may lose customers. Keeping pinsetters running properly is the job of bowling-pin-machine (or automatic pinsetter) mechanics.

When a pinsetter breaks or malfunctions, mechanics must quickly find the cause of the trouble and make repairs or adjustments so that bowlers will not be inconvenienced and annoyed. They refer to trouble-shooting manuals and diagrams of electrical circuits to guide their work. To fix the pinsetter, mechanics will repair, replace, or adjust broken mechanical or electrical parts such as gears, bearings, and motors.

Mechanics regularly service pinsetters to keep them operating properly. They inspect the machines for faulty parts and wiring, and also clean, lubricate, and adjust the gears, motors, and other moving parts.

Mechanics use many different types of tools, such as wrenches, screwdrivers, hammers, soldering irons, portable hoists, and lubricating guns, to repair and service the parts. They use ohmmeters, voltmeters, and other devices to test electrical circuits, relays, transformers, and motors.

Bowling-pin-machine mechanics spend much of their time inspecting and adjusting machines to prevent breakdowns.

Mechanics often supervise one or more assistant mechanics or pinchasers. Mechanics train these workers to locate and correct minor problems such as pin-jams, by demonstrating how the machines operate and by disassembling the machine and explaining the function of the parts. Assistant mechanics or the pinchasers maintain the pinsetters when the mechanic is off duty.

In some bowling centers, mechanics perform other maintenance such as polishing lanes, reconditioning pins, and repairing seats and tables. Mechanics do some clerical work. They order replacement parts and keep an inventory of parts in stock. They also may keep records of pinsetter malfunctions and estimate maintenance costs.

Places of Employment

About 5,800 bowling-pin-machine mechanics were employed in 1976. Almost all worked in bowling centers. A small number were employed by manufacturers of automatic pinsetters to install the machines and service those in bowling centers that do not employ full-time mechanics.

Bowling-pin-machine mechanics are employed in every State, but employment is concentrated in heavily populated areas, where there are many bowling centers.

Training, Other Qualifications, and Advancement

Generally, there are no education or experience requirements for a job as a pinsetter mechanic. Some employers, however, prefer to hire applicants who are high school graduates and who have completed courses in electricity, blueprint reading, shop math, and machine repair.

Pinsetter mechanics usually begin work as assistant mechanics and are trained informally on the job. Trainees learn about the pinsetter's operation and maintenance by observing head mechanics and working on the machines under their supervision. Trainees are taught how to lubricate and clean pinsetters and to perform other preventive maintenance.

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Trainees also learn to diagnose and repair various kinds of machine breakdowns. Usually, 1 to 2 years of on-the-job training and experience are needed to acquire mechanics' skills.

A few mechanic trainees are sent to training courses conducted by pinsetter manufacturers. To take these training courses, a mechanic must work at a bowling center. The bowling center usually pays the tuition for the courses.

The courses, which last 2 to 4 weeks, include classroom lectures and shop work with demonstration machines. Trainees study the structure and operation of machines made by the firm operating the school, and learn to locate typical sources of trouble. They learn to perform preventive maintenance, to read wiring diagrams, and to use the tools of the trade. After attending factory schools, trainees usually need several months of on-the-job experience to qualify as mechanics.

People who want to become bowling-pin machine mechanics should have good eyesight (including normal color vision), good eye-hand coordination, and average physical strength. They also should have mechanical ability and like to work with their hands. Because speed often is required in repairing pinsetters, ability to work under pressure also is important.

Advancement opportunities for pinsetter mechanics are extremely limited. Some mechanics become managers or owners of bowling establishments. Those who work for manufacturers may advance to service manager.

Employment Outlook

Employment of bowling-pin-machine mechanics is expected to grow more slowly than the average for all occupations through the mid-1980's. The demand for bowling facilities is likely to grow as the population increases. The growth in bowling facilities will be slower than in past years, however, so only a few new openings for pinsetter mechanics should occur. Most job openings will arise because of the need to replace experienced mechanics who retire, die, or leave the occupation for other reasons. However, because this occupation is very small, only a limited number of openings will become available.

Earnings and Working Conditions

Hourly earnings in 1976 ranged from $3 for mechanic trainees up to $5.50 for head mechanics, according to the limited information available.

Mechanics work in a long, relatively narrow corridor at the end of bowling lanes where the automatic pinsetters are located. The work area has space for a workbench and usually is well lighted and well ventilated, but quite noisy when the lanes are operating. When making repairs and adjustments, mechanics frequently have to climb and balance on the framework of the pinsetter, and to stoop, kneel, crouch, and crawl around the machines. Those who install and service machines for manufacturers must travel to the various bowling centers in their region.

The job generally is not dangerous but workers are subject to common shop hazards, such as electrical shock, cuts, falls, and bruises.

Some mechanics and trainees employed in large metropolitan areas are members of unions, usually the Service Employees International Union or the International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers of America (Ind.)

Sources of Additional Information

People who want further information about training or work opportunities in this trade should contact bowling centers in their area, the local bowling proprietors' association, or locals of the unions previously mentioned. The local office of the State employment service is another source of information about employment and training opportunities.

BUSINESS MACHINE REPAIRERS

(D.O.T. 633.281)

Nature of the Work

Business machine repairers maintain and repair the machines that are used to speed the paperwork in business and government. These include typewriters, adding and calculating machines, cash registers, dictating machines, postage meters, and duplicating and copying equipment. (Technicians who work on computer equipment are discussed in a separate statement elsewhere in the *Handbook*.)

Business machine repairers (often called field engineers or customer engineers) make regular visits for preventive maintenance to the offices and stores of customers in their assigned area. The frequency of these service calls depends upon the type of equipment being serviced. For example, an electric typewriter may require preventive maintenance only three or four times a year, while a more complex copier probably would require more frequent attention. During these calls, the engineer inspects the machine for unusual wear and replaces any worn or broken parts. Then the machine is cleaned, oiled, and adjusted to insure peak operating efficiency and to prevent future breakdowns. The engineer also may advise machine operators how to operate the equipment more efficiently and how to spot a problem in its early stages.

Despite frequent maintenance, business machines do occasionally malfunction. When a field engineer is notified by the supervisor of a breakdown, he or she will make a prompt service call to that customer. The engineer determines the cause of the malfunction by talking to the operator and examining the machine. Once the problem has been isolated, repairs can be made. Minor repairs generally can be made on the spot; for more serious repairs, however, the entire machine or a component of the machine will be taken to the repair shop where a specialist will work on it.

Business machine repairers generally specialize in one type of machine. Those employed by manufacturing companies or dealers usually are familiar only with the brand produced or sold by their employer. Repairers who work for small independent repair shops must be able to work on equipment from several different manufacturers.

Repairers use common handtools, such as screwdrivers, pliers, and wrenches, as well as other tools especially designed to fit certain kinds of business machines. In addition, they use meters and other types of test equipment to check for malfunctions in electronic circuits.

Places of Employment

About 58,000 people worked as business machine repairers in 1976. About three-fourths of them worked mainly on typewriters, calculators and adding machines, and copiers and duplicators. Most of the rest serviced accounting-bookkeeping machines, cash registers, and postage and mailing equipment. A small number repaired dictating machines.

About 8 of 10 repairers worked for business machine manufacturers, dealers, and repair shops. The remainder worked for large organizations that had enough machines to justify full-time repairers.

Business machine repairers work throughout the country. Even relatively small communities usually have at least one or two repair shops. Most repairers, however, work in large cities.

Training, Other Qualifications, and Advancement

The amount of formal education required for entry jobs as business machine repairers varies widely among employers. Some employers hire applicants with a high school education, while many others require at least 1 year of technical training in basic electricity or electronics. Employers agree, however, that electronics training received in the Armed Forces is valuable.

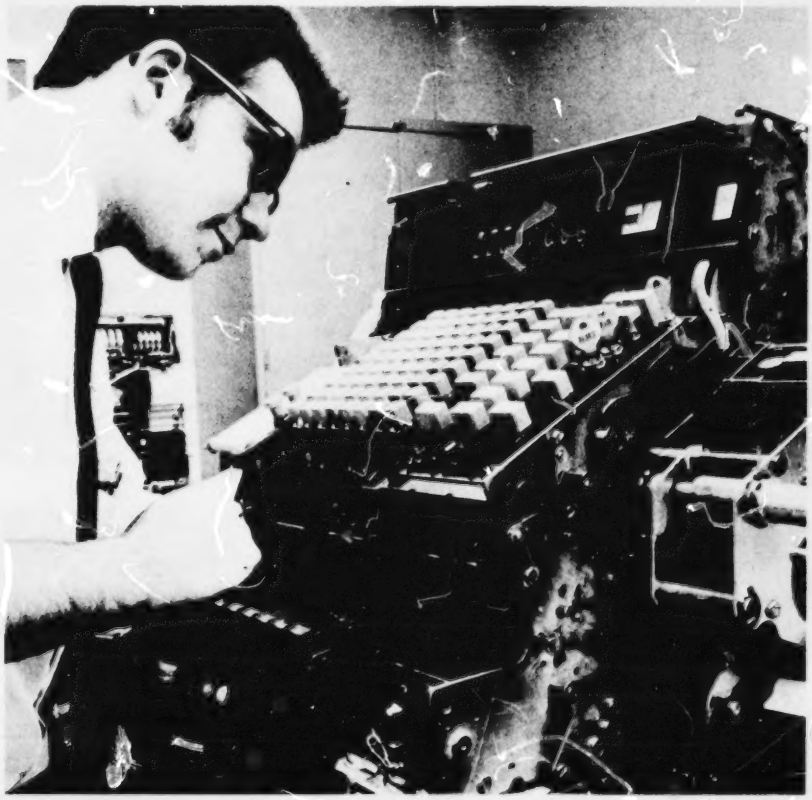
Applicants for entry jobs may have to pass tests that measure mechanical aptitude, knowledge of electricity or electronics, manual dexterity, and general intelligence. Good eyesight, including color vision, is needed to inspect and work on small, delicate parts. Persons considering this type of work also should have good hearing in order to detect malfunctions revealed by sound.

Employers seek applicants who have a pleasant, cooperative manner. Because most machine servicing is done in customers' offices, the ability to work without interrupting the office routine is very important. A neat appearance and ability to converse effectively are essential.

Some employers require that business machine repairers be bonded. Applicants for these jobs must be honest and trustworthy because they sometimes are exposed to large sums of money and other valuables in banks and offices. In addition, these workers must be able to work without direct supervision. They must be able to set up a maintenance schedule for their customers' equipment and arrange their own schedule so that they can meet service deadlines and also handle emergency repairs.

Trainees who work in a manufacturer's branch office or for a franchised dealer usually attend a school sponsored by the manufacturer. Training programs at company schools usually last several weeks to several months, depending on the type of machine the repairer will service. Trainees then receive from 1 to 3 years of practical experience and on-the-job training before they become fully qualified repairers. These workers generally learn to service only the company's line of equipment.

Training offered by independent repair shops usually is less formal. Trainees generally complete a self-study course coupled with on-the-job training under the supervision of an experienced repairer. Because small repair shops usually don't specialize



Business machine repair is cleaner and lighter than the work in most mechanical trades.

in the more sophisticated types of equipment, their repairers are expected to be familiar with the more common machines produced by many manufacturers. For example, business machine repairers in small shops should be able to repair several different makes of typewriters, adding machines, and calculators.

Wherever they work, business machine repairers frequently attend training seminars sponsored by business equipment manufacturers for special instruction in new business machine developments. Also, business machine repairers are encouraged to broaden their technical knowledge during nonworking hours. Many companies pay the repairer's tuition for work-related courses in college and technical schools.

Business machine repairers may move into sales positions for greater earnings. Repairers who show management abilities also may advance to service manager or supervisor. Experienced repairers sometimes open their own repair shops; those who work in manufacturers' branch offices sometimes become independent dealers or buy sales franchises from the company.

Employment Outlook

Employment of business machine repairers is expected to grow faster than the average for all occupations through the mid-1980's. In addition to jobs from employment growth, many openings will arise as experienced repairers retire, die, or change occupations.

Employment opportunities for qualified beginners are good. Business and government will buy more machines to handle the growing volume of paperwork and more people will be trained to maintain and repair these machines. In recent years, many technical changes have occurred in business machines. Electronic calculating machines have replaced mechanical models, for example, and electronic cash registers are replacing mechanical registers. Because of the greater use of such equipment, opportunities will be particularly favorable for repairers who have training in electronics; within several years training in basic electronics may even become a prerequisite for business machine repair jobs.

Business machine repairers work year round and have steadier employment than many other skilled workers. Office machines must be maintained, even when business slackens, since records must be kept, correspondence carried on, and statistical reports prepared.

Earnings and Working Conditions

Information from a limited number of employers in 1976 indicated that trainees earned from $150 to $200 a week, depending on their level of training. For example, people who have previous electronics training in the Armed Forces or civilian technical schools generally receive somewhat higher beginning wages than high school graduates.

Experienced repairers generally earned from $200 to $280 a week. Earnings usually were highest for those who repaired electronic business machines and complex duplicating and copying equipment. Repairers who prepare themselves to work on more than one type of equipment can increase their earnings by about 20 percent. Specialists earned salaries ranging between $220 and $310 a week in 1976, according to the limited information available.

Servicing business machines is cleaner and less strenuous than the work in most other mechanical trades. Repairers generally wear business clothes and do most of their work in the customer's office. Injuries are uncommon.

Repairers generally use their own cars to travel to their customers' offices and are reimbursed on a mileage basis. Employers usually pay for all tools and other equipment.

Sources of Additional Information

For more details about job opportunities, contact local firms that sell and service business machines and the local office of the State employment service.

The State department of education in your State capital can furnish information about approved technical institutes, junior colleges, and other institutions offering postsecondary training in basic electronics. Additional information about these schools is available from:

U.S. Office of Education, Division of Vocational/Technical Education, Washington, DC. 20202.

COMPUTER SERVICE TECHNICIANS

(D.O.T. 828.281)

Nature of the Work

Computer systems play a vital role in our lives. They help us make telephone calls, receive paychecks on time, and reserve tickets for travel, hotels, and entertainment. In business and industry, computer systems perform a wide variety of complicated tasks—from maintaining business records to controlling manufacturing processes.

A computer system is the combination of a computer and computer-related machines, such as magnetic tape readers and high speed printers. Keeping this intricate set of machines in good working order is the job of the computer service technician.

At regular intervals, computer service technicians (often called field engineers or customer engineers) service machines or systems to keep them operating efficiently. They routinely adjust, oil, and clean mechanical and electromechanical parts. They also check electronic equipment for loose connections and defective components or circuits.

When computer equipment breaks down, technicians must find the cause of the failure and make repairs. Determining where in the system the malfunction has occurred is the most difficult part of the technician's job, and as computer systems have grown larger and more complex, the potential for malfunctions also has grown. The problem can be in the central processing unit itself, in one of the peripheral machines, such as a reader or a printer, or in the cables connecting these machines. Technicians

use several kinds to test equipment, including voltmeters, ohmmeters, and oscilloscopes to check for electronic failures. They also run special diagnostic programs that help pinpoint certain malfunctions. Although it may take several hours to locate a problem, fixing the equipment may take just a few minutes. For repair jobs such as replacing a faulty circuit board, soldering a broken connection, or repairing a mechanical part, technicians use a variety of handtools, including needle-nosed pliers, wirestrippers, and soldering equipment. The employer supplies tools and test equipment, but technicians are responsible for keeping them in good working order.

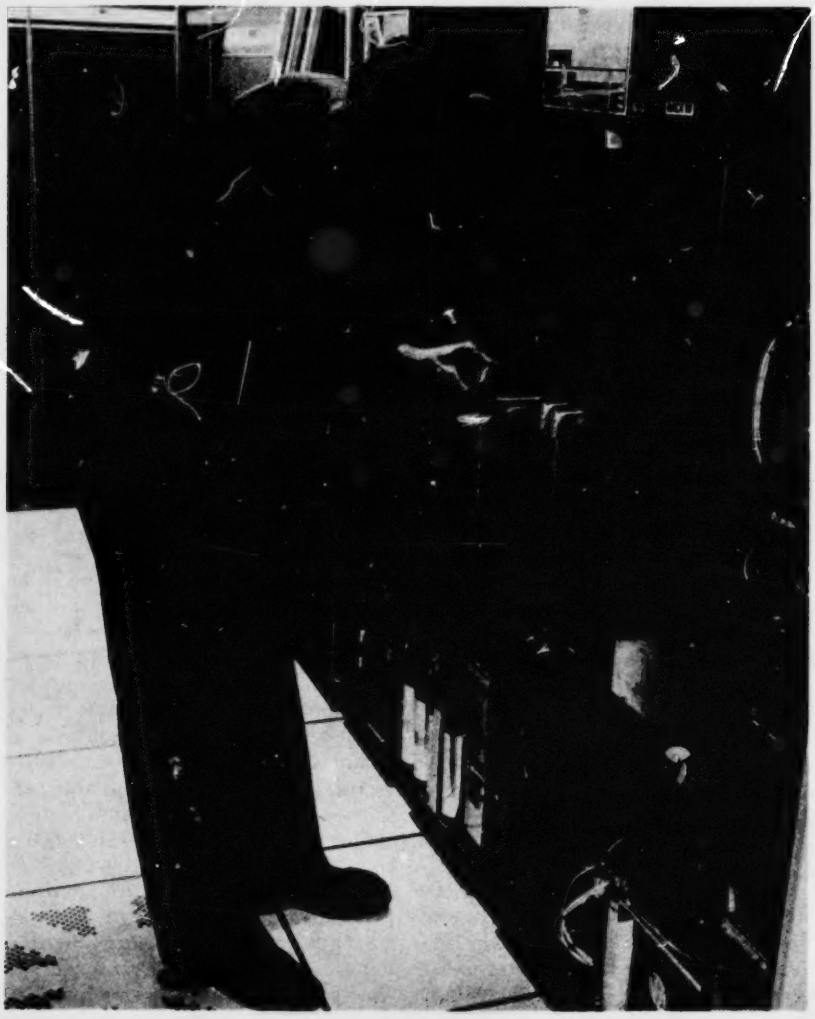
Computer technicians often help install new equipment. They lay cables, hook up electrical connections between machines, thoroughly test the new equipment, and correct any problems before the customer uses the machine.

Some technicians specialize in maintaining a particular computer model or system, or in doing a certain type of repair. For example, some technicians are experts in correcting problems caused by errors in the computer's internal programming.

Besides knowing how to use specialized tools and test equipment, computer technicians must be familiar with technical and repair manuals for each piece of equipment. They also must keep up with the technical information and revised maintenance procedures issued periodically by computer manufacturers.

Technicians keep a record of preventive maintenance and repairs on each machine they service. In addition, they fill out time and expense reports, keep parts inventories, and order parts.

Although technicians spend most of their time working on machines, they work with people also. They listen to customers' complaints, answer questions, and sometimes offer technical advice on ways to keep equipment in good condition. Experienced technicians often help train new technicians and sometimes have limited supervisory duties.



Some technicians specialize in maintaining a particular computer model or system.

Places of Employment

In 1976, about 60,000 persons worked as computer service technicians. Most were employed by firms that provide maintenance services for a fee and by manufacturers of computer equipment. A small number were employed directly by organizations that have a large computer installation.

Computer technicians generally work out of regional offices located in major urban centers, where computer equipment is concentrated. For example, about one-fourth of these workers are employed in one of these major cities: New York City; Philadelphia; Washington, D.C.; Chicago; and Los Angeles. Most are assigned to several clients, depending on the technician's specialty and the type of equipment the user has. Workers with several accounts must travel from place to place to maintain these systems and to make emergency repairs. In some cases, more than one technician will share an account, and service different parts of a system. In other cases, an experienced technician may be assigned to work full time at a client's installation in order to maintain all phases of that operation. Technicians who work for a nationwide organization must sometimes transfer to another city or State.

Training, Other Qualifications, and Advancement

Most employers require applicants for technician trainee jobs to have 1 to 2 years' post-high school training in basic electronics or electrical engineering. This training may be from a public or private vocational school, a college, or a junior college. Basic electronics training offered by the Armed Forces is excellent preparation for technician trainees.

A high school student interested in becoming a computer service technician should take courses in mathematics and physics. High school courses in electronics and computer programming also are helpful. Hobbies that involve electronics, such as operating ham or CB radios or building stereo equipment, also provide valuable experience.

Besides technical training, applicants for trainee jobs must have good close vision and normal color perception to work with small parts and color-coded wiring. Normal hearing is needed since some breakdowns are diagnosed by sound. Because technicians usually handle jobs alone, they must have the initiative to work without close supervision. Also important are a pleasant personality and neat appearance, since the work involves frequent contact with customers. Another important asset for the successful technician is patience, because some malfunctions occur infrequently and are very difficult to pinpoint. Applicants must pass a physical examination and, in some cases, get a security clearance.

Trainees usually attend company training centers for 3 to 6 months to learn elementary computer theory, computer math, and circuitry theory and to further their study of electronics. Classroom work is accompanied by practical training in operating computer equipment, doing basic maintenance, and using test equipment to locate malfunctions.

In addition to formal instruction, trainees must complete 6 months to 2 years of on-the-job training. At first they work closely with experienced technicians, learning to maintain card readers, printers, and other machines that are relatively simple, but that have the basic mechanical and electronic features of a large computer system. As trainees gain experience they work on more complex equipment.

Because manufacturers continually redesign equipment and develop new uses for computers, experienced technicians frequently must attend training sessions to keep up with these changes and to broaden their technical skills. Many technicians take advanced training to specialize in a particular computer system or type of repair. Instruction also may include programming, systems analysis, and other subjects that improve the technician's general knowledge of the computer field.

Experienced technicians with advanced training may become specialists or "troubleshooters" who help technicians throughout their territory diagnose difficult problems. They also may work with engineers in designing equipment and developing maintenance procedures. Technicians with leadership ability may become supervisors or service managers.

Most computer equipment operates on the same basic principles, but machines built by different companies may be unique in design and construction. For this reason, technicians may find it difficult to transfer between companies that mantain different brands of equipment. Because of the pressing need for experienced technicians, however, many opportunities exist for well-qualified workers to transfer to other firms that handle the same type of computer hardware.

Training and experience in computer maintenance may also qualify a technician for a job in programming, management, or equipment sales. (See statements on Programmers and Office Machine and Computer Manufacturing elsewhere in the *Handbook*.)

Employment Outlook

Employment of computer technicians is expected to grow much faster than the average for all occupations through the mid-1980's. As the Nation's economy expands, more computer equipment will be used and more technicians will be needed to install and maintain it. Business, government, and other organizations will buy, lease, or rent additional equipment to manage vast amounts of information, control manufacturing processes, and aid in scientific research. The development of new uses for computers in fields such as education, medicine, and traffic control also will spur demand.

Because most technicians are young, relatively few openings will stem from deaths and retirements. Most job openings will result from rising demand for the services of computer service technicians. Most openings will occur in metropolitan areas.

The rising demand for computer technicians is related to the growing number of computers in operation and the geographic distribution of these computers. Continued reductions in the size and cost of computer hardware will bring the computer within reach of a rapidly increasing number of small organizations. As more and more of these small systems are installed, the amount of time technicians must spend traveling between clients also will increase.

Downturns in the economy will tend to have a less negative effect on job openings for computer service technicians than for most occupations because even when business is declining firms will continue to use computers for accounting and other data processing.

Earnings and Working Conditions

Average weekly earnings of computer service technician trainees ranged from about $180 to $200 a week in 1976, according to a private survey of firms engaged in computer maintenance. Experienced workers earned about $235 a week, while senior technicians, those with 8-10 years' experience, earned between $250 and $285. Highly skilled specialists averaged from $310 to $340 a week.

Because computer installations generally run around the clock, working time lost during a computer breakdown can be very expensive. For this reason, technicians must be available to make emergency repairs at any time, day or night. Although

the normal workweek is 40 hours, overtime is standard. The method of assigning overtime varies by employer. Some technicians are on call 24 hours a day. Others work rotating shifts—days 1 week, nights the next. However it is implemented, computer technicians can expect substantial amounts of overtime; in many cases, annual overtime pay can be as much as 20 percent of base salary. For most technicians, travel is local and they usually are not away from home overnight. Employers pay for travel, including reimbursement for job-related uses of the technician's car, as well as work-related education expenses.

Although some bending and lifting is necessary, the computer technician's job is not strenuous. Work hazards are limited mainly to burns and electrical shock, and can be avoided if safety practices are followed.

Sources of Additional Information

For general information on careers in computer maintenance, contact the personnel department of computer manufacturers and computer maintenance firms in your area. The State department of education in your State capital can furnish information about approved technical institutes, junior colleges, and other institutions offering postsecondary training in basic electronics. Additional information about these schools is available from:

U.S. Office of Education, Division of Vocational/Technical Education, Washington, DC. 20202.

The State employment service office in your area may also be able to provide information about local job opportunities.

ELECTRIC SIGN REPAIRERS

(D.O.T. 824.281)

Nature of the Work

A common form of advertising for many businesses and products is the electric sign. Electric sign repairers maintain and repair neon and illuminated plastic signs so their owners can receive the most benefits from them.

When a sign requires service, repairers drive to its location, carrying their tools and a number of replacement parts in a truck. Repairers' trucks are equipped with ladders and boom cranes so they can work on tall signs or those placed high above the ground. Common sources of sign trouble such as burned-out bulbs are easy to fix. However, in some cases, the problem may not be obvious and repairers may need to use electronic test equipment to determine the cause of a breakdown. Although simple repairs such as replacing bulbs or transformers are done at the site, major repairs of faulty parts such as neon tubing, are made in sign shops.

Repairers also do preventive maintenance and periodic inspection of signs to locate and correct defects before breakdowns occur. They check signs and remove debris such as birds' nests and accumulated water. Repairers also tighten or weld parts that have been loosened by winds and repaint beams, columns, and other framework. They may repaint portions of neon tubing to make the sign more readable. Motors, gears, bearings, and other parts of revolving signs may be checked, adjusted, and lubricated.

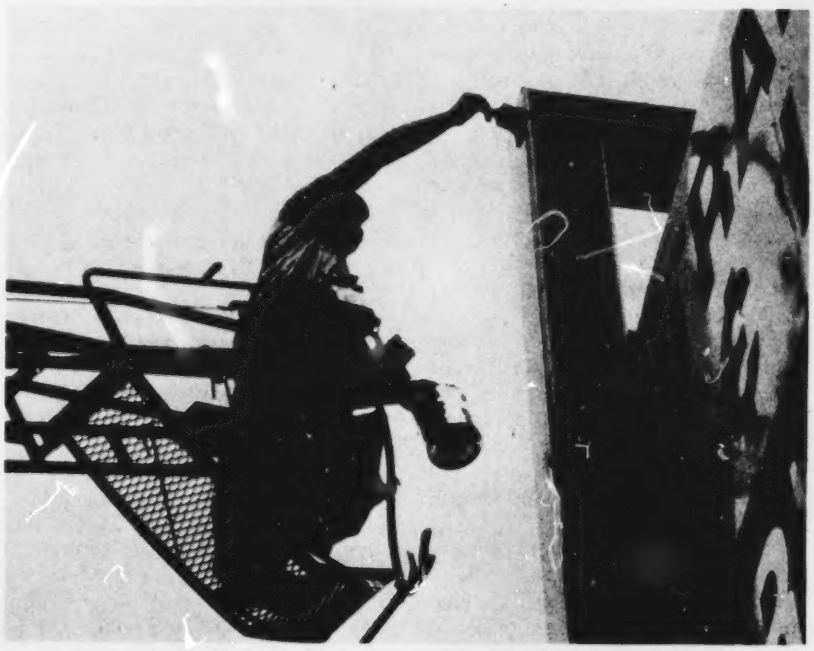
During periods with few service calls, repairers who work for sign manufacturing companies may help to assemble signs. Some repairers also install signs.

Repairers use common handtools and power tools, such as screwdrivers, pliers, saws, and electric drills. They also use ammeters, voltmeters, and other testing devices to locate malfunctioning electric parts. When replacing burned out parts such as a lamp or a flasher in illuminated plastic signs, repairers may refer to wiring diagrams and charts.

Repairers usually must fill out reports noting the date, place, and nature of service calls. They also may estimate the cost of service calls and sell maintenance contracts to sign owners.

Places of Employment

About 10,000 persons worked as electric sign repairers in 1976, primarily in small shops that manufacture, install, and service electric



Repairers do most of their work at sign locations.

signs. Some worked for independent sign repair shops.

Electric sign repairers work throughout the country. However, employment is concentrated in large cities and in populous States, where large numbers of electric signs are used.

Training, Other Qualifications, and Advancement

Most electric sign repairers are hired as trainees and learn the trade informally on the job. Trainees perform the various phases of signmaking in the shop to obtain a general knowledge of tasks—such as cutting and assembling metal and plastic signs, mounting neon tubing, wiring signs, and installing electrical parts. After they have a thorough knowledge of the construction of signs, trainees accompany experienced repairers on service calls to learn to do repairs and maintenance. At least 4 years of on-the-job training and experience are required to become a fully qualified repairer.

Some people learn the trade through sign repairer or electrician apprenticeship programs that are conducted by some union locals and sign manufacturing shops. The apprenticeships usually last 4 years, emphasize on-the-job training, and include classroom instruction in subjects such as electrical theory and blueprint reading. Apprentices generally must be at least 18 years old with a high school diploma. Attempts are being made by unions and the National Electric Sign Association to increase the number of apprenticeship programs, so the availability of this type of training should increase in the future.

Employers prefer to hire high school or vocational school graduates, although many repairers have less education. Courses in mathematics, science, electronics, and blueprint reading are helpful to young people who are interested in learning this trade.

Repairers need good color vision because electric wires are frequently identified by color. They also need manual dexterity to handle tools, and physical strength to lift transformers and other heavy equipment. Because much of their work is done on ladders or from the baskets of boom trucks, repairers cannot be afraid of heights.

All electric sign repairers must be familiar with the National Electric Codes. Many cities require repairers to be licensed. Licenses can be obtained by passing an examination in local electrical codes, and electrical theory and its application.

Highly skilled repairers may become supervisors. Because of their experience in servicing signs and dealing with customers, repairers sometimes become sign sales representatives. Repairers with sufficient funds can open their own sign manufacturing or repair shops.

Employment Outlook

Employment of electric sign repairers is expected to increase as fast as the average for all occupations through the mid-1980's. A rapid increase in the number of signs in use will spur demand for these workers. More signs will be needed as new businesses open and old ones expand and modernize their facilities. Signs already in use also will continue to require service because well maintained signs are good for business and also because many State and local governments require owners to keep their signs attractive. In addition to jobs from employment growth, some openings will arise as experienced workers retire, die, or leave the occupation for other reasons.

Earnings and Working Conditions

The earnings of electric sign repairers compare favorably with those of other skilled workers. It is estimated that the hourly wage rate of experienced repairers was about $7.80 in 1976, based on a survey of union wages and fringe benefits throughout the country. Apprentice rates usually range from $3.90 to $6.25 an hour.

Most electric sign repairers work an 8-hour day, 5 days a week, and receive premium pay for overtime. They also may receive extra pay for working at heights in excess of 30 feet.

Because most signs are out-of-doors, repairers are exposed to all kinds of weather. They sometimes make emergency repairs at night, on weekends, and on holidays. In some large cities, repairers patrol areas at night to locate and fix improperly operating signs. Hazards include electrical shock, burns, and falls from high places. Training programs emphasizing safety, and equipment, such as baskets on boom trucks, which allow easy access to signs, have reduced frequency of accidents. Repairers may spend much time traveling to the site of a service call.

Many electric sign repairers belong to one the following unions: the International Brotherhood of Electrical Workers, the Sheet Metal Workers International Association, and the International Brotherhood of Painters and Allied Trades.

Sources of Additional Information

For further information on work opportunities, contact local sign manufacturing shops, the local office of the State employment service, or locals of the unions previously mentioned.

General information on job opportunities, wages, and the nature of the work is available from:

National Electric Sign Association, 2625 Butterfield Rd., Oak Brook, Ill. 60521.

INSTRUMENT REPAIRERS

(D.O.T. 710.131, 710.281, 729.281, 823.281, and 828.281)

Nature of the Work

Nearly all areas of industry and research depend on measuring devices called instruments. For example, steel plants use hundreds of instruments to analyze, record and control their production processes. Airline pilots depend on instruments to navigate between airports and to make safe landings. Doctors use electrocardiographs and other medical instruments to diagnose and treat disease. Indeed, the variety and

applications of instruments are almost limitless. Repairing, servicing, and installing this equipment is the job of the instrument repairer, often called instrument technician.

Technicians usually specialize in the repair of instruments used by a particular industry such as process control instruments or aircraft navigation instruments. Because the instruments are different, the duties of repairers vary by industry, although much of the work is similar.

When an instrument is not working correctly, repairers attempt to determine the cause and correct the problem at the site. Often the repairer can fix the instrument by making a simple adjustment with a handtool or a minor repair such as resoldering a loose connection. If the cause of the breakdown cannot be located easily or major repairs are required, the broken instrument may be taken to the repair shop. In the shop, the technician disassembles the faulty instrument and examines the individual parts or the electric circuitry. When the source of the breakdown is located, the technician makes repairs such as replacing worn or damaged parts. After reassembling the instrument, the repairer uses test equipment to adjust the instrument and to check its accuracy.

In some cases, an instrument malfunctions because it is used improperly. Repairers often must understand the entire production process to determine whether the instrument, other equipment, or the operator is at fault. In such situations, repairers may have to show the operator how to use and care for the instrument properly.

Repairers also perform preventive maintenance in the field or by taking the equipment to the shop for inspection on a regular basis. At the shop, worn or defective parts that might break down are replaced or repaired. Instruments also are cleaned, lubricated, adjusted, and tested, before being replaced.

Technicans may install new instruments. After installation, the instruments are tested for accuracy and adjusted to insure their proper operation.

Repairers use testing equipment such as pressure gauges and voltmeters and information from maintenance manuals, electrical diagrams, and blueprints to locate malfunctions. They use handtools such as screwdrivers and wrenches, and bench tools such as jewelers' lathes and pin vises to make repairs and adjustments. In some companies, they operate drill presses, polishers, and other machine tools to make new parts or to change standard parts to fit particular instruments. When an instrument must be set precisely, they may use jewelers' loupes, micrometers, or microscopes.

Place of Employment

About 75,000 persons worked as instrument repairers in 1976. Most of them worked for the manufacturing industries that use instruments in automated production and process control systems such as petroleum and chemical firms, gas and electric utilities, and producers of paper, food products, steel, aluminum, rubber, aircraft, and automobiles. Large numbers of technicians were employed by instrument manufacturers to install and service their customers' equipment. Others worked for firms that offer installation and repair services to instrument users. A few thousand, primarily aircraft instrument repairers, worked for Federal agencies, mainly the Air Force, Navy, and Army.

Training, Other Qualifications, and Advancement

At least 4 years of on-the-job training and study usually are required in order to become an instrument repairer. However, training time depends upon individual ability, previous experience and training, and complexity of the instruments serviced.

Training for entry into the occupation is available from several sources. In plants using instruments, repairers generally are selected from production or maintenance employees or are hired as trainees. Training programs may be conducted informally on the job or through formal apprenticeships, which usually are established by union contract. Both types of training emphasize work experience with the instruments in the plant and often include courses in instrumentation theory, mathematics, blueprint reading, physics, electronics, and chemistry. These courses may be taken by correspondence or at technical schools and community colleges.

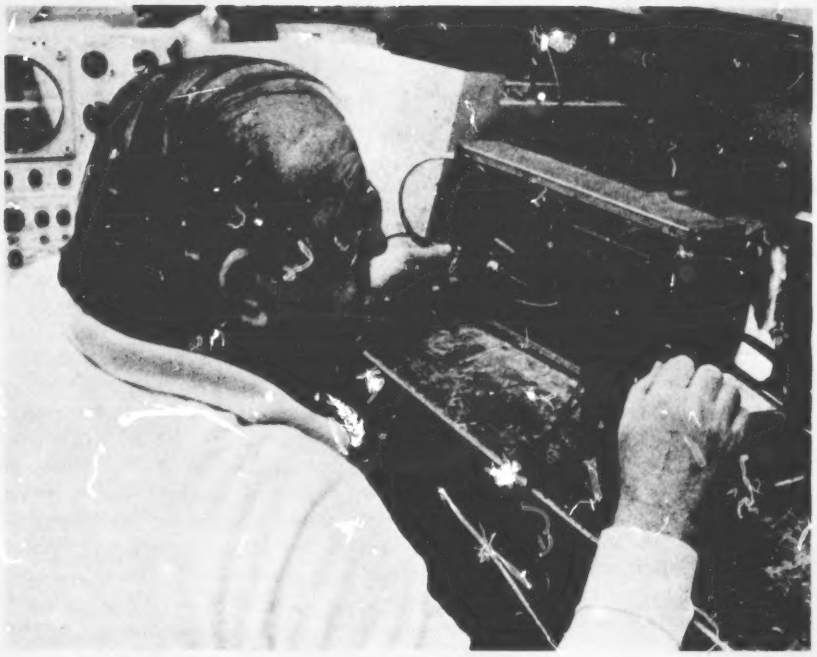
Some people train for instrument repair work in technical institutes and junior colleges that grant associate degrees in instrumentation. The curriculum in these schools usually includes courses in basic electricity, mathematics, applied sciences, and the operation and maintenance of particular instruments. Shop training with various instruments is emphasized. Programs offered by these schools usually last 2 years.

Armed Forces technical schools also offer excellent training in instrument servicing. Skills acquired in this way help a person qualify for a civilian job as an instrument repairer.

Several instrument manufacturers offer specialized training to experienced repairers employed by their customers. This training may last from 1 week to 9 months, depending upon the number and complexity of the instruments. Courses are given in theory, maintenance, and operation of the instruments produced by these manufacturers. Instrument repairers also keep up with new developments in their field by reading trade magazines and manufacturers' service manuals.

Trainees or apprentices generally must be high school graduates. Courses in algebra, trigonometry, physics, chemistry, electronics, machine shop, and blueprint reading are considered particularly useful and may be required for entry into junior colleges. Some employers give tests to applicants to determine their mechanical aptitude.

Good eye-hand coordination and finger dexterity are needed to handle delicate parts. The ability to work without close supervision also is important. Experience with electronic equipment such as building and maintaining a "ham" radio station is helpful for an individual planning to become an instrument repairer.



A good knowledge of electronics is helpful in instrument repair work.

Instrument repairers may become supervisors in maintenance and repair departments. Some may advance to positions as service representatives for instrument manufacturers. If they obtain additional education, instrument repairers may become engineering assistants or engineers. Instruments are becoming more complex, and technical school training is becoming an essential requirement for instrument repair work. This kind of training will provide a better base for advancement.

Employment Outlook

Employment of instrument repairers is expected to increase as fast as the average for all occupations through the mid-1980's. In addition to job openings caused by employment growth, many openings will result annually from the need to replace experienced repairers who retire, die, or leave the occupation for other reasons.

Additional instrument repairers will be needed because the use of technically sophisticated instruments for measurement, analysis, and control in industry and scientific research is expected to increase. Industrial instruments for process control in a number of industries including steel, food, and rubber are expected to increase substantially. In addition, more instruments will be used in research laboratories, aircraft and missiles, and automotive repair shops.

Opportunities for instrument repairers are expected to be particularly favorable in the petroleum, chemicals, and medical supplies industries, arising from increased emphasis on energy conservation and exploration, air and water pollution monitoring, and medical diagnosis.

Earnings and Working Conditions

According to the limited information available, instrument repairers received between $5 and $10 an hour in 1976. Those specializing in the repair of electronic instruments and systems often receive higher wages. Instrument repairers employed by Federal agencies receive rates comparable to those in private industry.

Most instrument repairers work a 40-hour, 5-day week. Those employed in process plants that operate around the clock may work on any of three shifts or rotate among shifts. Repairers also may be called to work with emergency crews at nights or on Sundays and holidays.

Work settings for instrument repairers vary from factory floors amid noise, heat, and fumes to quiet, clean, well-lighted shops. In some industries, such as chemicals, petroleum, and steel, repairers may have to work outdoors. Those employed by companies that service or manufacture instruments may travel frequently.

Many instrument repairers belong to unions, including the International Association of Machinists and Aerospace Workers; International Brotherhood of Electrical Workers; United Paperworkers International Union; International Chemical Workers Union; International Union of Electrical, Radio and Machine Workers; International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; Oil, Chemical and Atomic Workers International Union; United Steelworkers of America; Utility Workers Union of America; and United Association of Journeymen and Apprentices of the Plumbers and Pipefitters.

Sources of Additional Information

The local office of the State employment service may be a source of information about training and employment opportunities for persons who wish to enter this occupation. Additional information is available from:

Instrument Society of America, 400 Stanwix St., Pittsburgh, Pa. 15222.

Inquiries concerning positions with the Federal Government should be made at the regional offices of the U.S. Civil Service Commission.

MOTION PICTURE PROJECTIONISTS

(D.O.T. 960.382)

Nature of the Work

Projectionists are key behind-the-scenes workers in motion picture

theaters. From a booth in the back of the theater, projectionists operate movie projectors and sound equipment. Their duties vary with the type of equipment used.

In theaters with older equipment, projectionists use two projectors, sound equipment, a film rewinding machine, and seven reels of film or more. Before the movie begins, they examine the film, check the equipment to see that it works properly, and load the projectors with the first and second reels. After igniting and adjusting the extremely bright projector lamp which provides light for the screen, projectionists start the first reel. If the picture is out of focus or unsteady, they adjust the projector lens. Volume controls also may be adjusted if the sound is too loud or too soft.

A reel of film lasts 20 minutes or more. When the reel is almost complete, cue marks (small circles in the upper right corner of the picture) signal that it is time to start the second projector. After a second series of cue marks appears, the projectionist simultaneously closes the shutter on the first projector and opens the second one. This changeover happens so quickly that the audience does not notice an interruption on the screen. Next, the projectionist removes the first reel and rewinds it on the rewinding machine. The entire process is repeated until all the reels have been shown. When the film breaks, the projectionist must rethread it rapidly so that the show may continue.

Almost all new theaters and many renovated theaters have automated or semi-automated equipment. When the film is properly programed or "set-up," the machines automatically can dim houselights, open curtains, start the show with picture and sound, change from one projector to another, and rewind the film. This equipment also uses larger reels, which lessen the number of projector changeovers. In theaters with automated equipment, the projectionist's main job is the "setup" of the film.

A movie comes from a film exchange company on 7 to 12 individual reels of film. The projectionist splices the film from these reels and rewinds it on 2 to 3 reels or on one "platter." The projectionist also cues the program by placing small metallic tabs on the film that activate the various functions of the machinery such as the film changeover. The film must then be carefully inspected for flaws, which may cause the film to break during the showing. The projectionist loads the projector, ignites the light, adjusts the sound and picture, and starts the show.

In case of trouble such as a break in the film, the equipment shuts off until the projectionist can correct the problem. When a movie has finished its run in a theater, the projectionist must replace the film on the smaller reels for return to the film exchange company.

Projectionists also clean and lubricate equipment, check for defective parts and damaged film, and make minor repairs and adjustments. For example, they may replace a badly worn projector sprocket. Major repairs are usually made by service technicians who specialize in repairing projection and sound equipment. However, employers sometime seek a projectionist who can do all the repair work.

Places of Employment

An estimated 16,500 motion picture projectionists were employed full time in 1976. The majority worked for indoor theaters; most of the remainder worked for drive-ins. Some projectionists worked for large manufacturing companies, colleges, television studios, and Federal, State, and local governments.

Projectionists work in cities and towns of all sizes throughout the country. However, most jobs are in large metropolitan areas.

Training, Other Qualifications, and Advancement

Most theaters in urban areas are unionized and young people seeking jobs as projectionists generally must meet union membership requirements. The union locals establish these membership requirements, and they vary considerably among the locals. In nonunion theaters young people may start as ushers or helpers and learn the trade by working with an experienced projectionist.

Generally, unions prefer that applicants be high school graduates. In a few cities and States, projectionists must be licensed. The license often must be obtained before applying for union membership.

Some locals only admit applicants who have had experience with projection equipment. These applicants may work for a trial period in several theaters under the supervision of the regular projectionist. If they demonstrate an adequate knowledge of the projection equipment and its operation, they may join the union. The trial period usually lasts several weeks and during that time the applicant receives no pay.

Some locals conduct training programs which usually require no previous experience with projection equipment. Trainees learn the trade by working with projectionists. They first learn simple tasks such as threading and rewinding film, and progress to more difficult assignments such as adjusting and repairing equipment. A trainee often works in several theaters to become familiar with different types of equipment. Some training programs include classroom instruction in basic electronics and mechanics. After training, the applicant must pass a written exam about equipment use and maintenance; the applicant then becomes a union member. Trainees are not paid for their work in the theaters.

Persons interested in becoming projectionists should have good eyesight—including normal color perception—and good hearing. They should be temperamentally suited to working alone. Manual dexterity and mechanical aptitude also are important qualifications. High school courses in mechanics and electronics or practical experience gained from operating 16-millimeter projectors at school or in the Armed Forces is helpful.

Advancement opportunities for projectionists are limited. Some, however, become projectionist-managers and run many of the theater's daily operations.

Employment Outlook

Little change is expected in employment of motion picture projectionists through the mid-1980's. Most job openings will occur as experienced workers retire, die, or transfer to other fields of work. Applicants may face keen competition for the jobs that become available. Because earnings of motion picture projectionists are relatively high, applicants frequently outnumber job openings. In some areas, new union members may only be able to work part time as replacements for full-time projectionists.

The number of movie theaters is expected to increase more slowly than in recent years, because lack of new films will hurt the theaters' ability to compete with other forms of entertainment such as television. Furthermore, because of laborsaving innovations in equipment and theater design, employment of projectionists will not keep pace with theater growth. While older theaters had one screen and employed at least one projectionist, many new theaters are built with several screens side by side so that one projectionist, aided by automated projection machines and longer film reels, can run films for more than one auditorium at a time. The replacement of single screen theaters by those with multiple screens will slow the growth of projectionist jobs caused by new theater construction.

Earnings and Working Conditions

Average hourly earnings for projectionists in large metropolitan areas ranged from $5.18 to $16.50 in 1976, according to information from several union contracts. Wages vary among locals, the specific rate being determined by the type of theater, movie, and equipment involved. Generally, downtown theaters pay higher hourly rates than suburban or drive-in theaters. Projectionists who work more than one screen also receive extra pay.

Most projectionists work evenings; generally 4 to 6 hours on weekdays, and 10 hours or more on Saturday or Sunday. In theaters with weekday matinees, projectionists usually work 6 hours a day, 6 days a week. Some projectionists work at several theaters. For example, a weekly schedule may call for two evenings in each of three theaters. In small towns, projectionists usually work only part time because of the small number of shows. Projectionists employed at drive-ins—particularly in northern States—may be laid off for several months during the winter.

Projection rooms usually have adequate lighting and ventilation, and some are air-conditioned. The work is not strenuous and is relatively hazard free, but there is danger of electrical shock and acid burns from the projector's lamp if proper safety precautions are not taken. Although projectionists must stand a lot, they may sit for short periods while the equipment is operating. Most projectionists work without direct supervision and have infrequent contact with other theater employees.

Sources of Additional Information

Details about training programs and employment opportunities may be obtained from any local of the International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators of the United States and Canada.

VENDING MACHINE MECHANICS

(D.O.T. 639.381)

Nature of the Work

Vending machines have become a familiar scene in everyday life. In places of recreation, work, and education, vending machines provide everything from a piece of candy to a full-course meal.

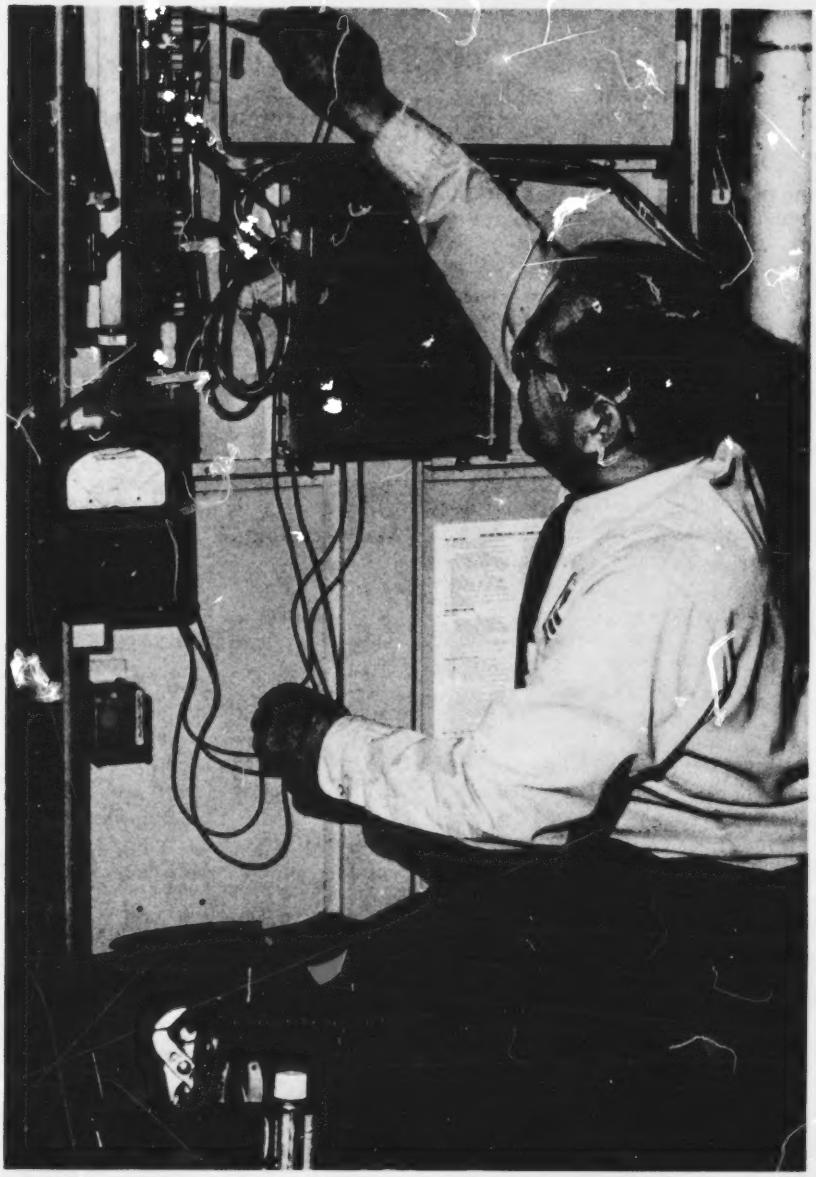
Vending machine mechanics keep these machines in good working order. They also may assemble and install machines and, in some cases, stock them with merchandise. Some mechanics work only in repair shops and some work only in the field, but many do both. Those who work in the field are assigned a service truck to travel between locations.

In preparing machines for installation, mechanics follow instructions supplied by the manufacturer. After the machine is put together and tested, the mechanic fills it with products or ingredients and gives it a test run. When working on complicated machines, such as beverage or food dispensers, mechanics check to see that the machines give proper quantities of ingredients and that refrigerating and heating units work properly. On gravity-operated machines, mechanics check springs, plungers, and merchandise delivery systems. They also test coin and change-making mechanisms. When installing machines on location, mechanics make the necessary water and electrical connections and recheck the machine for proper operation.

Preventive maintenance—avoiding trouble before it starts—is another major part of the job. For example, mechanics periodically clean electrical contact points, lubricate mechanical parts, and adjust machines to perform properly. When a machine breaks down, mechanics must determine the cause of the trouble. They first inspect the machine for obvious problems, such as loose electrical wires, malfunctions of the coin mechanism, and leaks. If the problem cannot be readily located, they may refer to troubleshooting manuals and wiring diagrams and use testing devices such as electrical circuit testers to find defective parts. Mechanics then repair or replace the faulty parts, either on location or in the employer's service shop.

Mechanics use pipe cutters, soldering irons, wrenches, screwdrivers, hammers, and other handtools. In the shop, they also may use power tools, such as grinding wheels, saws, and drills.

Mechanics who install and repair food vending machines must know State public health and sanitation standards as well as those established under local plumbing codes. They also must know and follow safety procedures, especially when lifting heavy objects and working with electricity and gas.



Preventive maintenance is a major part of the job of vending machine mechanics.

Mechanics must do some clerical work, such as filing reports, preparing repair cost estimates, and ordering parts. Those employed by small operating companies frequently service as well as repair machines. These combination "mechanic-routeworkers" stock machines, collect money, fill coin and currency changers, and keep daily records of merchandise distributed. (Additional information about vending machine route drivers is included in the statement on route drivers elsewhere in the *Handbook*.)

Places of Employment

In 1976, about 25,000 mechanics maintained and repaired more than 5 million vending machines. Most mechanics work for vending service companies that install machines and provide services, such as cleaning, stocking, and repairing. Other mechanics work for beverage companies that have coin-operated machines or for companies that own and operate juke boxes, pin-ball machines, and laundry and drycleaning machines. Some mechanics are employed as instructors by vending machine manufacturers to explain technical innovations and ways to repair new machines to other mechanics. Although mechanics are employed throughout the country, most are located in industrial and commercial centers where there are a large number of vending machines.

Training, Other Qualifications, and Advancement

Persons usually enter this trade as general shop helpers or vending machine route drivers. If shop helpers or route drivers show promise as mechanics, they may become trainees. Some workers are hired directly as mechanic trainees.

Most trainees learn the trade informally on the job by observing, working with, and receiving instruction from experienced mechanics. Trainees usually start out by doing simple jobs such as cleaning, painting, or refurbishing machines. From there, they move on to rebuilding these machines—removing defective parts, repairing and adjusting them, and testing the machines. Next, they go on service calls, accompanying an experienced mechanic, and then go out on their own, calling upon the expertise of highly skilled mechanics or manufacturers' field engineers when necessary. At this point they have completed their on-the-job training. This process takes from 6 months to 3 years, depending on the individual's capabilities, previous education, and the quality of instruction. Some employers encourage both trainees and experienced mechanics to take evening courses in subjects related to machine operation and repair—for example, basic electricity and refrigeration. Employers often pay for at least part of the tuition and book expenses for these courses.

To learn about new and complex machines, employees sometimes attend manufacturer-sponsored training sessions. Instruction takes place either in manufacturers' service divi-

sions in major cities or in operators' repair shops. Employers usually pay wages and expenses during these sessions, which may last from a few days to several weeks.

Many beginners are high school graduates, but employers generally do not require a diploma. High school or vocational school courses in electricity, refrigeration, and machine repair help beginners to qualify for entry jobs and may help beginners to skip the lowest rung of the job ladder—general shop helper. There are now 15 high schools and colleges in the country offering 1- to 2-year training programs in vending machine mechanics.

Employers require applicants to demonstrate mechanical ability, either through their work experience or by scoring well on mechanical aptitude tests. Since mechanics are exposed to thousands of dollars in merchandise and cash, employers will hire only applicants who have a record of honesty and respect for the law. The ability to deal tactfully with people also is important. A commercial driver's license and a good driving record are essential for most vending machine repair jobs.

Skilled mechanics may be promoted to senior mechanic or, in large companies, to shop supervisor. Advancement to service manager, who schedules repair work, is possible for mechanics having administrative ability.

Employment Outlook

Vending machine business will increase as population grows and as more industrial plants, hospitals, stores, and other establishments move to suburban areas where restaurants are not always close by. Growth in the number of vending machines will create more jobs for mechanics.

However, employment of vending machine mechanics is expected to grow more slowly than the average for all occupations through the mid-1980's. Most job openings will arise as a result of the need to replace experienced mechanics who retire, die, or transfer to other occupations. Because this is a small occupation, the number of openings will be relatively small.

Earnings and Working Conditions

Wage rates for vending machine mechanics ranged from $3.45 to $6.56 an hour in 1976, based on information from a small number of union contracts.

Most vending machine mechanics work 8 hours a day, 5 days a week, and receive premium pay for overtime. Since vending machines can be operated around the clock, mechanics sometimes work at night and on weekends and holidays. Some union contracts stipulate higher pay for nightwork and for emergency repair jobs on weekends and holidays.

Vending machine repair shops generally are quiet, well-lighted, and have adequate workspace. However, when servicing machines on location, mechanics may work in cramped quarters, such as passageways, where pedestrian traffic is heavy. Repair work is relatively safe, although mechanics are subject to shop hazards such as electrical shocks and cuts from sharp tools and metal objects.

Many vending machine mechanics employed by large companies are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America.

Sources of Additional Information

Further information on job opportunities can be obtained from local vending machine operators and local offices of the State employment service. For general information on vending machine mechanics, as well as a list of schools offering courses in vending machine mechanics, write to:

National Automatic Merchandising Association, 7 S. Dearborn St., Chicago, Ill. 60603.

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What to Look For in this Repri[illegible]

To make the *Occupational Outlook Handbook* easier to use, each occupation or industry follows the same outline. Separate sections describe basic elements, such as work on the job, education and training needed, and salaries or wages. Some sections will be more useful if you know how to interpret the information as explained below.

The TRAINING, OTHER QUALIFICATIONS, AND ADVANCEMENT section indicates the preferred way to enter each occupation and alternative ways to obtain training. Read this section carefully because early planning makes many fields easier to enter. Also, the level at which you enter and the speed with which you advance often depend on your training. If you are a student, you may want to consider taking those courses thought useful for the occupations which interest you.

Besides training, you may need a State license or certificate. The training section indicates which occupations generally require these. Check requirements in the State where you plan to work because State regulations vary.

Whether an occupation suits your personality is another important area to explore. For some, you may have to make responsible decisions in a highly competitive atmosphere. For others, you may do only routine tasks under close supervision. To work successfully in a particular job, you may have to do one or more of the following:

- motivate others
- direct and supervise others
- work with all types of people
- work with things—you need good coordination and manual dexterity
- work independently—you need initiative and self-discipline
- work as part of a team
- work with details, perhaps numbers or laboratory reports
- help people
- use creative talents and ideas
- work in a confined area
- do physically hard or dangerous work
- work outside in all types of weather

A counselor can help you find out more about your interests and abilities so you can judge whether a job's characteristics suit you.

The EMPLOYMENT OUTLOOK section tells whether or not the job market is likely to be favorable. Usually an occupation's expected growth is compared to the average projected growth rate for all occupations (20.1 percent between 1976 and 1985). The following phrases are used:

Much faster	50% or more
Faster	25.0 to 49.9%
About as fast	15.0 to 24.9%
Slower	4.0 to 14.9%
Little change	3.9 to -3.9%
Decline	-4.0% or more

Generally, job opportunities are favorable if employment is growing at least as fast as for the economy as a whole.

But, you would have to know the number of people competing with you to be sure of your prospects. Unfortunately, this supply information is lacking for most occupations.

There are exceptions, however, especially among professional occupations. Nearly everyone who earns a medical degree, for example, becomes a practicing physician. When the number of people pursuing relevant types of education and training and then entering the field can be compared with the demand, the outlook section indicates the supply/demand relationship as follows:

Excellent	Demand much greater than supply
Very good	Demand greater than supply
Good or favorable	Rough balance between demand and supply
May face competition	Likelihood of more supply than demand
Keen competition	Supply greater than demand

Competition or few job openings should not stop your pursuing a career that matches your aptitudes and interests. Even small or overcrowded occupations provide some jobs. So do those in which employment is growing very slowly or declining.

Growth in an occupation is not the only source of job openings because the number of openings from turnover can be substantial in large occupations. In fact, replacement needs are expected to create 70 percent of all openings between 1976 and 1985.

Finally, job prospects in your area may differ from those in the Nation as a whole. Your State employment service can furnish local information.

The EARNINGS section tells what workers were earning in 1976.

Which jobs pay the most is a hard question to answer because good information is available for only one type of earnings—wages and salaries—and not even this for all occupations. Although 9 out of 10 workers receive this form of income, many earn extra money by working overtime, night shifts, or irregular schedules. In some occupations, workers also receive tips or commissions based on sales or service. Some factory workers are paid a piece rate—an extra payment for each item they make.

The remaining 10 percent of all workers—the self-employed—includes people in many occupations—physicians, barbers, writers, and farmers, for example. Earnings for self-employed workers even in the same occupation differ widely because much depends on whether one is just starting out or has an established business.

Most wage and salary workers receive fringe benefits, such as paid vacations, holidays, and sick leave.

Workers also receive income in goods and services (payment in kind). Sales workers in department stores, for example, often receive discounts on merchandise.

Despite difficulties in determining exactly what people earn on the job, the Earnings section does compare occupational earnings by indicating whether a certain job pays more or less than the average for all nonsupervisors in private industry, excluding farming.

Each occupation has many pay levels. Beginners almost always earn less than workers who have been on the job for some time. Earnings also vary by geographic location but cities that offer the highest earnings often are those where living costs are most expensive.

What's an ad for the OOQ doing in a place like this?

The career information contained in the reprint you are reading was taken from the 1978–79 edition of the Occupational Outlook Handbook. But the Handbook is not the only source of useful career information published by the Bureau of Labor Statistics. The Handbook's companion, the Occupational Outlook Quarterly, is published four times during the school year to keep subscribers up to date on new occupational studies completed between editions of the Handbook. The Quarterly also gives practical information on training and educational opportunities, salary trends, and new and emerging jobs—just what people need to know to plan careers.

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